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Page 2

# Children's height, health and appetite influence mothers' weaning decisions in rural Senegal

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**Background** In many developing countries, breastfed children have a lower nutritional status than those weaned from 12 months of age. Reverse causality, that is, earlier weaning of healthy and well-nourished children, is a possible explanation.

**Methods** Maternal reasons for early and late weaning were investigated in a cohort of 485 rural Senegalese children using structured interviews during two rounds at the ages of 18-28 and 23-33 months, respectively. Length, weight and height were assessed, and dates of weaning were monitored.

**Results** The mean duration of breastfeeding was 24.1 months (quartiles 21.9 and 26.3). Two-thirds of mothers of breastfed children under 2 stated that they would wean at the age of 2, while for breastfed children aged 2 years, a 'tall and strong' child was the most prevalent criterion. The main reasons for weaning prior to 2 years (N = 244) were that the child ate well from the family plate (60%), that the child was 'tall and strong' (46%) and maternal pregnancy (35%). The main reasons for weaning later than the age of 2 were: a 'little, weak' child (33%), food shortage (25%), illness of the child (24%) and refusal of family food (14%, N = 120). Children breastfed above the age of 2 because they were 'small and weak' had lower mean height-for-age and a greater prevalence of stunting than children breastfed late for other reasons ( $P < 0.0001$ ).

**Conclusion** The habit of postponing weaning of stunted children very likely explains why breastfed children have lower height-for-age than weaned children in this setting.

**Keywords** Breastfeeding, weaning, reverse causality, toddlers, stunting, Africa

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Maternal motivations for cessation of breastfeeding have received increased attention in recent years because long durations of breastfeeding are associated with an increased prevalence of malnutrition in many developing countries,<sup>1-5</sup> even after adjustment for potential confounders.<sup>1,3</sup> Several authors have suggested that this relationship may be due to reverse causality, that is, that mothers prolong breastfeeding when the child is already malnourished.<sup>2-5</sup>

Some 25 years ago longitudinal studies in Africa and Latin America provided evidence that the shortest children were the last to be weaned.<sup>5,6</sup> Recently, malnutrition (low height-for-age or weight-for-age) prior to weaning has been shown to remain

significantly associated with delayed weaning in multivariate analyses adjusting for maternal characteristics.<sup>7-10</sup> In rural Senegal, a clear linear relationship was found between stunting at 9 months of age and the duration of breastfeeding: the prevalences were 6.4, 9.5, 17.6 and 26.6%, respectively, for durations of 12-17, 18-23, 24-29 and 30-48 months ( $P$  for trend  $< 0.0001$ ).<sup>10</sup> It seemed very unlikely that residual confounding could be responsible for such a close association. However, we had no direct evidence that mothers considered their children's nutritional status as important for timing of weaning, or that they were able to evaluate height-for-age correctly. Indeed, some researchers have reported or suggested that mothers do not consider nutritional status *per se*, but rather use developmental criteria such as the child's physical and mental independence from the mother (ability to walk or to eat independently, willingness to be separated from the mother).<sup>11,12</sup>

In order to further investigate the relationship between nutritional status and duration of breastfeeding, a cohort of

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young children was followed prospectively from 2 months to about 3 years of age in the same area of rural Senegal. The objective of this paper was to assess maternal reasons for both early and late weaning, defined in relation to the median duration of breastfeeding of 24 months, using interviews with the mothers.

## Subjects and Methods

### Data collection

The study was conducted in the Niakhar study area in central Senegal, West Africa, which is located about 150 km east of the capital, Dakar. This area is rather densely inhabited by nearly 30 000 people belonging to the Sereer ethnic group, of whom more than 90% are farmers growing millet and groundnuts during the short rainy season from July to October. The main reported religions are Islam (75%) and Christianity (20%). From 1994 to 1996, the infant mortality rate was 77 and the under-5 mortality rate was 182 per 1000.<sup>13</sup> Fertility is high, with a total fertility rate estimated at 7.1 live-born children per woman.

Study infants were born from January to October 1995. Prior to home visits, precise birth dates were obtained from the central database together with birth ranks, and age, education and occupation of parents. Dates of weaning, collected weekly until February 1997 and bimonthly thereafter, were taken from the database at the end of the study, in April 1998.

Two home visits were done, in May and October 1997, when the children were aged 18–28 and 23–33 months, respectively. Weight and length (together with height for children aged  $\geq 24$  months) were measured using standard methods. The data regarding maternal motivations for initiating or delaying weaning were collected by two female interviewers native to the area. In May 1997, mothers of breastfed children were first asked which criteria they would use to evaluate the right moment for weaning ('How will you know when your child is ready to be weaned?'). This question was open-ended. During both rounds, mothers of weaned children were asked about reasons for weaning, while mothers of breastfed children aged  $\geq 2$  years were asked about reasons for continuation of breastfeeding. The latter questions proposed lists of reasons, but additional reasons given were noted as well. The lists had been elaborated during a preliminary study conducted in 1995–1996 in the same area among 100 mothers of 24-month-old children, half of whom were weaned. First, lists of reasons for weaning and for prolonging breastfeeding were elaborated after discussions with older women living in the area, and with field workers and research technicians native to the area. Some reasons mentioned frequently in the literature were also included (items 7–8 in Table 3 and item 5 in Table 4). These lists were tested during the preliminary study, and reasons given by several mothers were added (item 4 in Table 3). Conversely, the item 'child aged  $\geq 2$  years' was excluded from the list of reasons for weaning because it had been chosen by all mothers, and was thus not discriminating. Finally, the interviewers were instructed not to accept another common answer ('it was time to wean'). Instead, the mother was asked to explain how she evaluated this. Information about the quality of maternal housing (type of wall and of roof) and the existence of latrines was also collected, and the material used for the walls (mud bricks or cement) was used as an indicator of economic status.

Among 505 mother-child pairs residing in the study area in May 1997, 485 mothers were present during at least one of the two rounds. Reasons for weaning prior to 24 months were investigated for 244 children out of 248 (98.4%), while reasons for later weaning included 155 children out of 237 (65.1%), since the remaining children were still being breastfed during the second survey. Reasons for prolonging breastfeeding beyond 24 months were investigated only for children aged  $\geq 24$  months and still being breastfed at the time of the interviews ( $N = 120$ , 50.6%). Thus, children weaned prior to the first interview ( $N = 82$ ), or aged  $< 24$  months at the first interview and weaned prior to the second interview ( $N = 35$ ) were not included since it was not possible to know their exact age at weaning at the time of the surveys.

### Statistical analysis

The reasons the mothers gave during the interviews for (1) planning weaning, (2) having weaned and (3) prolonging breastfeeding above the median age of 24 months, were listed by decreasing frequency. Frequency of reasons for having weaned were compared according to the child's age at weaning ( $< 24$ ,  $\geq 24$  months) and bivariate associations between reasons were tested, using  $\chi^2$  tests or Fisher's exact test. Duration of breastfeeding was compared for each reason for weaning independently, using the Mann-Whitney rank sum test. No global test was performed since several reasons were cited for many children.

Height-for-age was computed using the WHO-NCHS growth reference and Anthro software. Mean height-for-age of 2-year-old children was compared according to the reason for prolonging breastfeeding and age using two-way ANOVA, while comparisons of the prevalence of stunting used  $\chi^2$  tests. All analyses were performed using the BMDP statistical software package.

## Results

Characteristics of the sample are given in Table 1. Mean age at weaning was 24.1 months (SD: 3.6), and half of the children were weaned between the ages of 21.9 and 26.3 months. Socio-economic factors associated with a lower mean age at weaning were any kind of maternal education ( $P < 0.01$ ), a lower maternal age in a nearly linear relationship ( $P < 0.001$ ) and better housing ( $P < 0.05$ ).

### When the children were to be weaned

The single most important criterion cited for cessation of breastfeeding while the child was still being breastfed and below the age of 24 months was the child's age (Table 2). The fact that the child was 'tall and strong' or 'ate family food well' was cited either as the single condition or—more often—as an additional condition paired with age. For children aged  $\geq 24$  months, a 'tall and strong' child was the most prevalent criterion cited.

Some mothers planned to wean at the end of the rainy season, just after the harvest ('in November–December when groundnuts are plentiful and there will be money from the sale of groundnuts to buy food for the child'). The next preferred season was prior to the rainy season, in May–June, because the mothers wanted to leave their child in the compound while doing field work, or because the father would then return from seasonal migration for labour and bring money back.

Table 1 Characteristics of the sample (N = 485)

Variable	N	%
<b>Sex</b>		
Boy	236	48.7
Girl	249	51.3
<b>Birth order</b>		
1-3	172	35.5
4-6	158	32.6
7-9	117	24.1
≥10	38	7.8
<b>Maternal age (years)</b>		
<20	57	11.8
20-24	118	24.3
25-29	80	16.5
30-34	104	21.4
≥35	126	26.0
<b>Maternal education</b>		
None	445	92.3
Primary	29	6.0
Secondary	8	1.7 <sup>a</sup>
<b>Maternal activity</b>		
Domestic	441	90.9
Maid	29	6.0
Miscellaneous	15	3.1
<b>Maternal hut</b>		
Mudbricks	353	79.9
Cement	89	20.1 <sup>a</sup>
<b>Latrines</b>		
No	360	81.8
Yes	80	18.2 <sup>a</sup>

<sup>a</sup> Data are missing for some children.

Several mothers mentioned the child's social behaviour, i.e. his or her ability to play freely with the other children in the compound or to be separated from the mother for half a day without crying. Walking was cited by a few mothers because their children, aged 19-27 months, did not walk well yet.

#### Why were the children weaned?

The two most frequent reasons for weaning prior to 24 months were that the child 'ate family food well' or that he or she was 'tall and strong', while the child's age was the most frequent reason for those weaned at 24 months or later (Table 3). A 'tall and strong child' and 'ate family food well' were closely associated ( $P < 0.0001$ ). Conversely, the 'tall and strong' item was less likely to be cited when the child was weaned because of pregnancy ( $P < 0.0001$ ).

Child-driven weaning and illness of the child were seldom reasons for weaning, and were often related to the mother's pregnancy ( $P < 0.001$  and  $P < 0.05$ , respectively). Several mothers explained child-driven weaning during pregnancy by a decrease in breast milk secretion. Four children ill with diarrhoea during their mother's pregnancy were weaned because the mothers believed that their pregnancy had modified the quality of breastmilk and caused the illness. The remaining ill child was weaned because he had been hospitalized for 2 months far from his home.

Table 2 Criteria mothers planned to use for deciding weaning while their children were still breastfed, by child age at the time of the interview (%)

Criteria	18-23 mo (N = 201)	24-28 mo (N = 34)
At age 2 years	63.7	17.6**
At age 2.5 years	4.5	8.8
When child eats well	11.4	8.8
When child is tall and strong	16.9	41.2**
End of rainy season	10.4	2.9
Before rainy season	4.0	5.9
Father's decision	6.5	5.9
Maternal pregnancy	5.5	8.8
When child is healthy	5.5	2.9
When child accepts separation	4.0	0
When child walks	3.0	5.9
Moslem feast	2.0	2.9
When child stops sucking	2.0	0
At next birth	1.5	0
When child plays freely	1.5	0
All teeth present	1.5	5.9
When child talks	1.0	0
When mother wants freedom	0.5	0
Mean no. of criteria per child	1.5	1.2

\*\* $P < 0.01$  for differences between children aged < or ≥ 24 months.

Maternal illness responsible for weaning was severe: cholera (2), tuberculosis (2), malaria (1) and unknown (2). Maternal migration for labour was a feature of unmarried, primiparous mothers. They left their child in the care of their own mother while working in the capital city, Dakar.

#### Risk factors for early weaning

Nine children (1.9%) had been weaned prior to 18 months, two because their mother had died, one because of severe maternal illness (cholera), three because of maternal pregnancy and three because their mothers were maids in Dakar. Half (50.6%) of the 85 children weaned prior to 21 months were weaned because of pregnancy.

The children weaned because of maternal pregnancy, migration for labour or illness were weaned significantly earlier than those not weaned for these reasons ( $P < 0.01$ ,  $P < 0.001$  and  $P < 0.01$ , respectively, Table 3). Conversely, those weaned because they were 'tall and strong' or 'ate family food well' were weaned significantly later than the other children ( $P < 0.001$  and  $P < 0.01$ , respectively).

#### Why were some children still breastfed above the age of 2?

The main reasons for prolonging breastfeeding above the age of 24 months were that the child was 'little and weak', current or frequent morbidity of the child and food shortage in the household (Table 4). Some mothers were not aware that their child was aged ≥24 months (range: 24.1-25.1 months). In October, several mothers stated that they avoided weaning because of lack of money and food and because of a high prevalence of illnesses at that time of the year. A low appetite for family food was often reported together with a 'little and weak' child: the proportion of

**Table 3** Prevalence of maternal reasons for weaning by the child's age at weaning (%), and duration of breastfeeding (months) by reason

	<24 mo (N = 244)	≥24 mo (N = 155)	All (N = 399)	Duration breastfeeding Mean ± SD
<b>Reasons given in the list:</b>				
1. Child ate family food well	60.2	72.7*	64.7	23.5 ± 2.7 §§
2. Child was tall and strong	45.9	67.1***	53.9	23.9 ± 2.6 §§§
3. Maternal pregnancy	35.2	25.2*	31.3	22.4 ± 2.8 §§
4. Maternal field work	8.6	3.3*	6.5	22.7 ± 2.8
5. Maternal travel/migration	8.2	3.2	5.8	21.1 ± 3.4 §§§
6. Child doesn't want to suck	6.1	5.2	5.8	22.5 ± 3.1
7. Mother was ill	2.0	0.6	1.8	18.3 ± 4.6 §§
8. Child was ill	1.7	0.6	1.3	22.8 ± 3.8
<b>Reasons added by the mothers:</b>				
Child was ≥2 years	17.6	74.2***	40.1	24.1 ± 2.5
New birth	1.2	1.3	1.3	22.3 ± 3.0
Maternal death	1.2	0	0.8	12.8 ± 0.3
Paternal death	0.8	0	0.5	21.8 ± 1.3
Fasting month (Ramadan)	0.4	0	0.3	22.8
Insufficient milk	0.4	0	0.3	23.6
Mother wanted to stop	0	0.6	0.3	26.3
Marriage of mother	0	0.6	0.3	24.4
<b>Mean no. of reasons per child</b>	<b>1.9</b>	<b>2.5</b>	<b>2.1</b>	

\* $P < 0.05$ ; \*\*\* $P < 0.001$  for differences in prevalence by child age at weaning.

§§  $P < 0.01$ ; §§§  $P < 0.001$  for differences in duration of breastfeeding between children for whom this reason was cited and those for whom it was not.

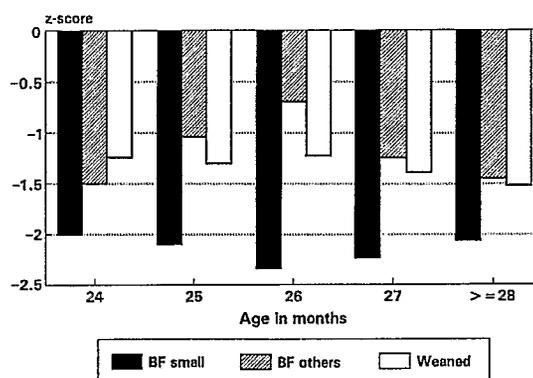
Age at weaning was missing for 2 children.

**Table 4** Maternal reasons for prolonging breastfeeding beyond 24 months of age (%), N = 120

	%
<b>Reasons given in the list:</b>	
1. The child is too little or weak	32.5
2. There is a food shortage	25.0
3. The child is or has been ill	24.2
4. The child refuses family food	14.2
5. Family food is too expensive	1.7
<b>Reasons added by the mothers:</b>	
Age below 2 years	11.7
Rainy season	9.2
Father's decision	6.7
Mother likes to breastfeed	5.8
Weaning failure	1.7
To avoid pregnancy	1.7
Child doesn't walk	0.8
Missing teeth	0.8
Mother not pregnant	0.8
<b>Mean no. of reasons per child</b>	<b>1.4</b>

'small and weak' children was 59% among those with a low appetite for family food compared to 28% among the remaining children ( $P = 0.01$ ). No other reasons were significantly associated.

The two cases of relactation after an attempt to wean were motivated by prolonged crying and chronic diarrhoea associated with weight loss, respectively. Maternal concerns were seldom mentioned, though two women aged 39 and 41 years, with



**Figure 1** Mean height-for-age of children breastfed above the age of 24 months either because they were 'small and weak' or for other reasons, compared to children weaned prior to 2 years of age

parities of 10 and 8, respectively, declared prolonging breastfeeding in order to avoid a new pregnancy.

#### Height-for-age by reason for prolonging breastfeeding

Children breastfed above the age of 2 years because they were 'small and weak' had a significantly lower mean height-for-age (at the age of 24–33 months) than children breastfed above this age for other reasons ( $P < 0.0001$ , Figure 1). As expected, their mean height-for-age was also significantly lower than that of children in the same age range, weaned prior to the age of 2 ( $P < 0.001$ ). Interestingly, children breastfed above the age of 2

for reasons not related to their nutritional status had a mean height-for-age similar to that of children weaned prior to the age of 2 (Figure 1).

The prevalences of moderate and severe stunting (height-for-age between  $-2$  and  $-3$  z-scores and below  $-3$  z-scores, respectively) were extremely high among children breastfed above the age of 2 because they were 'small and weak' (31.6 and 23.7%, respectively). For comparison, these prevalences were 13.1 and 8.3%, respectively, for children breastfed beyond this age for other reasons ( $P < 0.001$ ).

## Discussion

This study combined interviews with mothers regarding planned and actual criteria for duration of breastfeeding with precise observations of duration and nutritional status. Planned criteria did not always agree with actual reasons for weaning (results not shown), suggesting that some mothers had cited the cultural norm rather than their precise plans—or that their plans had changed. Some child-related factors, such as height, health and appetite were important for maternal decisions, while others seemed quantitatively less important (dentition, ability to walk and talk). Mother-centred factors such as maternal illness, fatigue and malnutrition were rarely mentioned, probably because of the strong positive value of breastfeeding in this society. Economic factors sometimes delayed weaning, mainly because the mother wanted to give purchased food to her newly weaned child. Very early weaning, prior to 18 months of age, did not seem to be explained by child factors but rather by major maternal events (death, severe illness, pregnancy or migration).

The importance of the child's health in the mother's weaning decision has been described previously, using either interviews with mothers<sup>14,15</sup> or epidemiological evidence,<sup>8</sup> although in some settings, both health and disease may be reasons for weaning.<sup>16</sup> Similarly, the ability to consume the total family diet was a reason for weaning in one setting,<sup>15</sup> while a low appetite for family food was a reason for weaning in others.<sup>17,18</sup> As far as we know, no studies have yet provided evidence that the child's height affects the mother's weaning decisions directly, although observations in a rural area of Nigeria suggested that 'sturdy' children were weaned earlier.<sup>5</sup>

Data were missing for some of the children. Reasons for weaning were available for virtually all children weaned prior to 24 months, but only for two-thirds of those weaned later than that. However, for children weaned later than the cultural norm, reasons for prolonging breastfeeding were more informative than reasons for weaning. The latter were actually rather misleading, since some children breastfed above the age of 2 because they were 'small and weak' finally were weaned when they became 'tall and strong enough'. Thus, reasons for weaning are difficult to interpret independently of age at weaning.

Reasons for prolonging breastfeeding beyond 24 months of age were only available for those who were still breastfed whilst aged 24 months or more during a survey, since age at weaning was not known precisely at the time of home visits. This design thus biased the sample towards children with the longest durations of breastfeeding (mean: 28.1 months versus 25.6 months for the children not included despite an age at weaning  $\geq 24$  months,  $P < 0.001$ ). This is probably why most mothers gave clear motivations for delaying weaning.

Another methodological point to be mentioned is that the use of lists in the investigation of reasons for weaning and for delaying weaning probably increased the proportion of multiple answers, and possibly incited mothers to add reasons which were not essential to them, while reasons not given in the list probably were less likely to be cited. Allowing several reasons per child made interpretation of maternal motivations easier, and allowed for analysis of associations among reasons.

The study confirmed that the children's height-for-age was causally linked to the duration of breastfeeding, and was possibly even more important than their health status. The fact that mothers stated that height intervened in their decisions is a very strong argument in favour of reverse causality. Mothers who considered that their child was not 'tall enough', explained that they evaluated his or her height by comparing it to that of other children born at approximately the same time. The analyses showed that these children indeed had very low mean height-for-age, and great prevalence of both severe and moderate stunting.

The interpretation of the mother's perception of a child as 'tall', that we give here as being based on height, has been interpreted differently in other studies. Madurese mothers consider their children as 'big' when they are physically independent rather than tall.<sup>19</sup> For Peruvian mothers, the expression of a big ('grande') child encompasses age, motor and language development as well as nutritional status.<sup>14</sup> However, these Senegalese mothers consistently stated that the Sereer expression '*maq*' meant 'tall for the child's age', while '*yal dolé*', strong, referred to the child's physical strength, i.e. 'strong arms'.

The habit of weaning at the age of 2 years is extremely common in this community, and has also been reported in other Sahelian countries,<sup>17</sup> while in Nigeria and Ethiopia, mothers reported that they did not wean at any particular age.<sup>5,20</sup> However, this age criterion was modulated according to the child's physical state, in both directions. The mothers' knowledge of their children's age was largely accurate: few mothers of children aged  $\geq 24$  months stated that their child was younger than that, and these children were seldom aged  $> 25$  months. Mothers usually did not recall birth dates, but rather the time of year (season, agricultural calendar) and religious feasts close to the time of birth.

Fathers, and paternal grandmothers seemed to play an important role in maternal decisions, mainly by asking the mother to postpone weaning, and some kind of negotiation between parents was occasionally reported, especially if the child was weaned prior to 2 years or was ill or malnourished. Pregnancy was a frequent reason for early weaning, as described in many other settings,<sup>14-18,21-23</sup> and pregnancy was the only situation in which breastfeeding mothers reported being under pressure from family and neighbours to wean.

In conclusion, this study confirmed the importance of the child's height, health and appetite for maternal weaning decisions. The custom of prolonging breastfeeding when a child is stunted, and of reducing the duration when the child is tall, very likely explains why breastfed toddlers are shorter than weaned children of similar age in this population.

The possibility of reverse causality should be considered in all studies from developing countries comparing breastfed and weaned children in terms of risks of malnutrition, morbidity and mortality.

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# Commentary: Does breastfeeding for longer cause children to be shorter?

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Historically, prolonged lactation has been a traditional practice in many communities, reportedly reaching 15 years amongst Eskimos in 19th century King William Land.<sup>1</sup> Nevertheless, there has long been speculation that extended breastfeeding adversely impacts on maternal and child health. A note in the *Lancet* in 1842 records the case of a woman who breastfed

her child for over 3 years and then developed epilepsy.<sup>1</sup> The attending physician wrote: 'The worst symptoms of debility at last attended this monstrous proceeding'.

More recently an association between prolonged breastfeeding, typically defined as any breastfeeding beyond the first year of life, and malnutrition has been reported.<sup>2,3</sup> At face value this finding calls into question current advice that children should continue to be breastfed, while receiving appropriate and adequate complementary foods, until at least 2 years of age.<sup>4</sup> However, a

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non-causal explanation for the observed association, namely that poorly growing children continue to be breastfed,<sup>2</sup> is investigated by Simondon *et al.* in a study published in the current edition of this journal.<sup>5</sup>

### Public health significance

Establishing the nature of the association between prolonged breastfeeding and childhood growth is an important public health issue. Firstly, breastfeeding offers anti-microbial, nutritional, hygienic, economic and psychological benefits to infants and mothers.<sup>6</sup> Breastfeeding also acts as a contraceptive and may indirectly improve the food supply to the child by reducing pressure on family resources. Infectious diseases account for the majority of the 12 million deaths annually in children under 5 years of age in less developed countries,<sup>7</sup> and in rural Senegal where Simondon *et al.* conducted their investigation the under-5 mortality rate is 182 per 1000. There is clear evidence that prolonged breastfeeding protects against serious morbidity and mortality from gastrointestinal and respiratory infections into the second year of life, with higher levels of protection seen in populations with high child mortality.<sup>8-10</sup> During infections, breast milk intakes are maintained while the consumption of weaning foods falls substantially.<sup>6</sup> Therefore the advice given by some authors to shorten the duration of breastfeeding in the case of poor growth<sup>11</sup> might be very dangerous in countries already plagued by poverty and infectious disease.<sup>9</sup>

Secondly, the prevalence of prolonged breastfeeding is high in many less developed countries, particularly in sub-Saharan

Africa (Figure 1).<sup>3</sup> Therefore any causal association between breastfeeding and impaired growth may imply a large absolute risk of malnutrition related to prolonged breastfeeding, depending on the strength of the association. Thirdly, there are policy implications for infant-feeding education and health promotion. Contrary to widespread expectation, the duration of breastfeeding is increasing in many less developed countries, perhaps reflecting the simplicity of the 'breast is best' message.<sup>12</sup> Reports that prolonged breastfeeding is associated with poor growth have created controversy concerning the messages that should be given to women about feeding methods.<sup>13</sup> Saying that some breastfeeding is good but breastfeeding for too long is bad may be inconsistently interpreted by different health workers and breastfeeding mothers leading overall to greater risk of suboptimum nutrition.<sup>14</sup>

### Inconsistencies in results

In a review of 13 studies by Grummer-Strawn in 1993, 8 reported inverse associations between prolonged breastfeeding and growth, 2 found a positive relationship and 3 showed mixed results.<sup>2</sup> Since then a case-control<sup>15</sup> and a cross-sectional<sup>14</sup> study have both found positive associations between extended breastfeeding and nutritional status. These two studies suggest opposite conclusions to those reached by earlier workers, namely that either prolonged breastfeeding protects against malnutrition or that malnutrition leads mothers to stop breastfeeding.

Inconsistencies in results between studies have been attributed to variations in the quantity and quality of weaning

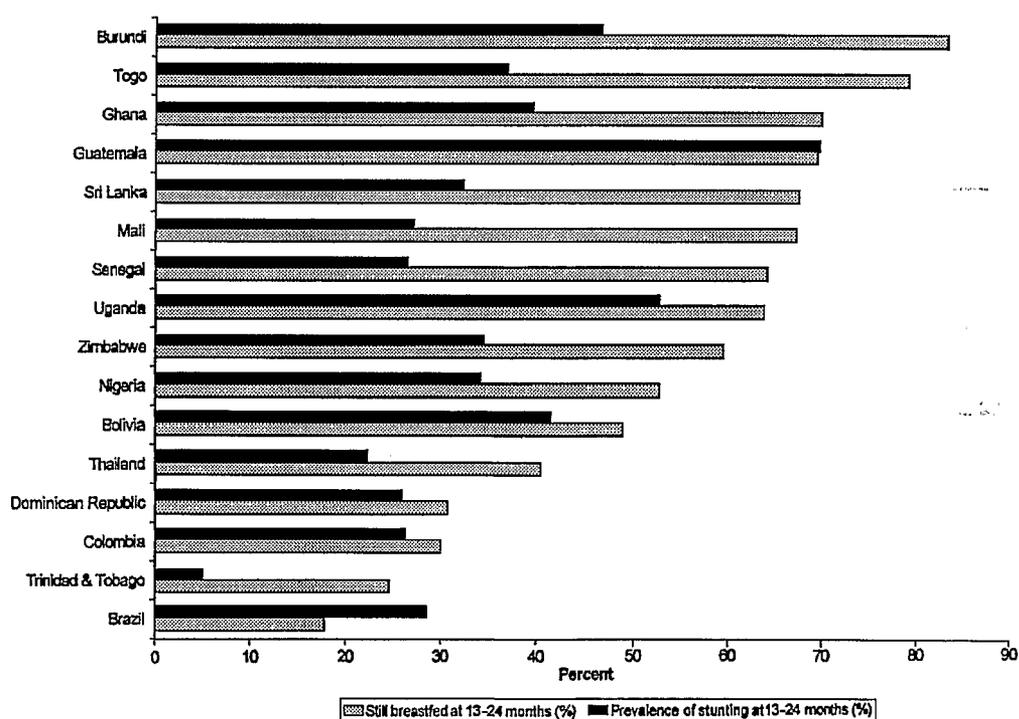


Figure 1 Prevalence of breastfeeding and stunting (height-for-age  $<-2SD$ ) at 13-24 months of age. Adapted from Caulfield *et al.*<sup>3</sup>

foods used to supplement breast milk,<sup>16</sup> differences in the definition of malnutrition,<sup>2</sup> or because of inadequate control of the potential confounding influences of adverse social conditions.<sup>17</sup> Selection bias is another potential explanation for the finding of poor growth amongst children breastfed into their second year. This would occur if a beneficial survival effect was operating, whereby breastfed malnourished children are more likely to survive than those who were weaned,<sup>18</sup> perhaps mediated by immune factors conveyed from mother to child.<sup>19</sup>

### Reverse causality

Another explanation is that childhood size is related to the decision to wean. However, studies that have shown an association between breastfeeding and malnutrition are generally cross-sectional and do not allow investigation of the direction of the relationship between prolonged breastfeeding and nutritional status. It is likely that a complex interplay of factors determine patterns of childhood feeding and weaning as well as children's growth and development.<sup>20</sup> Clearly, an understanding of malnutrition in a particular community requires knowledge of the cultural context within which feeding and weaning decisions are made in that community.

The study by Simondon *et al.* published in this journal investigated maternal reasons for early and late weaning amongst 485 rural Senegalese children.<sup>5</sup> Planned reasons for weaning were the child's age if still breastfed and under 2 years old, and a 'tall, strong child' if the child was still breastfed after 24 months. The most frequent reasons for actual weaning were that the 'child ate family food well', the child was 'tall and strong' and maternal pregnancy. Maternal reasons for prolonging breastfeeding were if the child was 'too little or weak', there was a food shortage and current or frequent morbidity. Children whose breastfeeding was prolonged because of perceived small stature were more likely to be stunted than those in whom breastfeeding was prolonged for other reasons.

Other authors have shown that age, general development and health are important considerations in decisions about breastfeeding duration.<sup>6</sup> Simondon *et al.*'s study is the first to directly support the suggestion by Caulfield *et al.* that mothers take into account a child's size in weaning decisions.<sup>3</sup> This hypothesis was first proposed to explain an interaction between age and duration of breastfeeding on nutritional status in a large multinational study in developing countries.<sup>3</sup> In those countries outside sub-Saharan Africa older, still breastfed children were shorter and lighter than those no longer breastfed, an association which did not appear until 12–18 months of age and became greater over time. In contrast, in sub-Saharan Africa younger still breastfed children were shorter and lighter than those no longer breastfed, but differences largely diminished over time. A unifying interpretation of the observed association is that in sub-Saharan Africa the biggest children were weaned first, whereas in countries outside sub-Saharan Africa the smallest children were weaned last.<sup>3</sup>

Doubt about the nature of the association remains since to effectively identify reverse causality will require a long-term longitudinal study to determine accurately the temporal ordering of weaning and growth faltering. Nevertheless there are other data which suggest that the inverse association between breastfeeding and growth is likely to be non-causal. Firstly, a

prospective study of the relationship between breastfeeding in Britain in the 1920s and 1930s and growth in childhood through to adulthood found that breastfeeding was positively associated with childhood stature, and that this positive association appeared to persist into adulthood.<sup>21</sup> Secondly, a study from New Zealand showed that breastfed children were significantly taller than formula-fed children at age 7 years.<sup>22</sup> The effect disappeared when skeletal maturity was included in a multivariable model, suggesting that breastfeeding may influence growth tempo, the rate at which a child matures. Finally, breastfeeding positively influences various hormones affecting growth.<sup>23–25</sup>

### Remote effects of breastfeeding

As long ago as 1938 Spence wrote in the *British Medical Journal*, 'It is possible that some of the serious degenerative diseases of adult life have their origins in the artificial feeding of infancy'.<sup>26</sup> Any public health assessment of the risks and benefits of breastfeeding must also consider the potential beneficial impact of breastfeeding on adult chronic diseases, such as coronary heart disease and diabetes.<sup>27,28</sup>

### Conclusion

Clearly, further studies are needed to clarify whether prolonged breastfeeding is a response to poor growth and ill health, or is a precursor of inadequate energy intake, malnutrition and/or diarrhoeal diseases.<sup>9</sup> Frankel *et al.* have drawn attention to a system of lay epidemiology, where people interpret health risks by integrating information from their observation of cases of illness and death within personal networks.<sup>29</sup> It is likely that, by drawing upon personal knowledge of benefits and risk, mothers in Senegal have developed weaning strategies which optimize child survival, i.e. they continue to breastfeed children who are undernourished or ill because of an awareness of the high mortality risk among weaned children. In the absence of clear evidence that the association between breastfeeding and malnutrition is likely to be causal, the traditional custom of prolonged breastfeeding should be encouraged.

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